How Did the Alkali Bee Cross the Road? Assessing Transportation Impacts to Alfalfa Seed Production in the Walla Walla Valley

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Introduction

The Washington State Department of Transportation (WSDOT) is proposing safety improvements to US Highway 12 near the town of Touchet, Washington. The improvements include realignment to the north in order to accommodate a wider roadway and avoid impacts to the towns of Touchet and Lowden. The proposed realignment route is within the Touchet-Lowden-Gardena alfalfa seed growing district, an area critical to alfalfa seed production. The most effective and efficient pollinator for alfalfa is the alkali bee (*Nomia melanderi*), a native ground-dwelling bee that is raised in bee beds by area farmers. Relocation of the highway will bisect several bee beds and alfalfa fields. During the National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA) analysis it was found that these impacts are unavoidable. As a way to better understand Alkali Bees and their role in the alfalfa seed industry as well as to test potential mitigating designs WSDOT contracted with Washington State University (WSU) entomologists to conduct a four-year study on alkali bee populations and flight paths.

Materials and Methods

The study has three objectives: 1) survey the population abundance of alkali bee beds across the region; 2) determine bee flight paths (flight height, distance, and bearing) from bee beds to alfalfa fields and back, and; 3) assess the potential for barriers or other measures to effectively alter bee flight paths on both the vertical and horizontal planes. Methods to accomplish these objectives included a population survey to estimate the abundance of alkali bees by using a "coring" device compared to surface quadrat counts (Cane 2008), constructing a "vehicular bee sweeper" designed to capture insects at specific heights over the roadway, and placing barriers of different heights and materials near bee beds to study flight characteristics.

Results and Discussion

1.) To date, significant differences ($p<0.001$) in bee abundance per location have been found. Bee beds vary in size and population abundance.

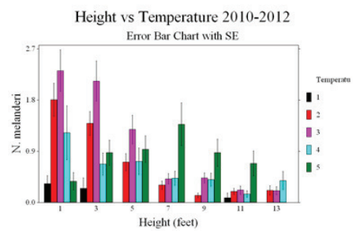
2.) The vehicular bee sweeper provided data regarding flight height and environmental condition correlatives. Height had a significant effect on alkali bee flight ($p<0.001$).

We pooled the samples from each height among the kilometers driven and calculated the mean number of alkali bees we captured (Table 1).

Height (m)	Alkali bees	Cumulative %
0.3	1.81	35.5
0.9	1.58	70.3
1.5	0.77	86.2
2.1	0.28	92.0
2.7	0.15	95.2
3.4	0.13	97.8
3.9	0.11	100.0

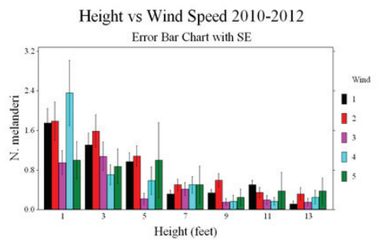
Table 1. The mean number of bees captured per mile at specific height intervals by the vehicular bee sweeper in July 2012.

Our results indicated that 81.3% of the alkali bees were flying over roads at heights below 2.1 m in 2010, 78.2% in 2011, and 92% of alkali bees were caught at 2.1 meters or below in 2012.



The majority of alkali bees flew at heights below 2.1 meters when no other factors were considered, but environmental conditions such as temperature and wind speed had a definite effect on number of flights and flight heights of alkali bee.

Most alkali bees were caught flying over roads when wind speeds remained between 0-4 km/h, despite wind speed having no significant effect on the flight height of alkali bees (Fig.).



3.) A "proof of concept" study was conducted where tall screens were placed adjacent to bee beds, and bee flight paths and characteristics were studied. The hypothesis was that if bees were required to elevate above traffic heights (about 4.3 meters) in order to cross the roadway initially, they would remain high enough to successfully cross before returning to ground-level. However, it was found bees would drop to lower heights immediately after flying over the screen, likely because of environmental conditions prohibiting higher flights and the barrier provided no change in alkali bee flight height.

Due to the low-flying nature of the native alkali bee, vehicle strikes can be expected to cause mortality in bisected populations.

Conclusions

By studying alkali bee population abundance and flight characteristics, WSDOT can better understand the potential impacts of the proposed project on bee populations and alfalfa seed producers. Ultimately, recommendations will be made to highway designers to minimize and mitigate these effects.

Literature cited

Cane, J.H. (2008) A native ground-nesting bee (*Nomia melanderi*) sustainably managed to pollinate alfalfa across an intensively agricultural landscape. *Apidologie* 39, 315–323.

Acknowledgments

We would like to thank the Washington State Department of Transportation. A special thanks to all of the alfalfa seed growers who volunteered their land and bee beds for this research, especially Mike Buckley. We would also like to thank the summer interns and the Walsh lab for their help in the field collecting data.

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